

The Fate of Saharan Dust Across the Atlantic: An Integrated Modeling and Observational Study of the TC4 Field Campaign

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During the NASA TC-4 field campaign in July 2007, several Saharan dust events were observed over the Caribbean basin. A-Train observations suggest that these Saharan dust events are confined the Caribbean and rarely transported across Central America to the Pacific Ocean. We investigate the nature of this barrier to dust transport using the NASA GEOS-5 atmospheric general circulation model. Our simulations with GEOS-5 are driven by the Modern Era Retrospective-Analysis for Research and Applications (MERRA) meteorological analyses, and include online simulation of aerosol distributions using a version of the Goddard Chemistry, Aerosol, Radiation, and Transport (GOCART) model. Simulated dust distributions are evaluated using A-Train observations from MODIS and CALIOP, as well as MISR and ground-based AERONET sun photometers, and show good agreement with the observations in terms of the timing and magnitude of dust events. A component analysis of the dust transport and removal pathways is used to evaluate the relative roles of these processes in establishing the observed dust transport barrier. From this analysis, we show that while both atmospheric dynamics and wet removal contribute towards the Caribbean dust barrier, northward dust transport is the more dominant term. Additional simulations are performed to ascertain the sensitivity of our results to uncertain loss processes (i.e., wet removal) in our model.